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The grey relational degree measurement of city's S&T input and sustainable economic development based on the data from hunan province

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Abstract

This paper discusses the correlation of S&T input and sustainable economic development. In order to fully reflect the relations, this paper chooses S&T input indicators (S&T expenditure and S&T personnel) and economic development indicator (gross product in different industries), using grey relational degree analytical method, to measure the correlation between two indicators. Taking 12 cities of Hunan province as the empirical analysis, this paper finds that the correlation of S&T personnel and economic development is stronger than S&T expenditure and economic development. In territory industry, S&T input is not significant in pushing sustainable economic development.

Keywords: S&T input; indicators;sustainable economic development; Hunan Province

1. Introduction

Development is the theme of this era. Researchers used to take GDP as the primary indicator to evaluate a nation or a city's development statues. With the deepening research, as well as the situations of imbalanced resources allocation appeared in 1960s, people began to question the existing evaluation system, and put forward the theory of sustainability development theory. With the impetus of newly established S&T revolution, knowledge plays more and more important role in economic development, which pushes the accumulation of social fortune and human beings welfare [1]. Most countries in the world

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put great emphasis on the increasing rate of S&T input, especially on the input of R&D, which is deeply related with the innovative ability upgrade [2]. According to http://www.sts.org.cn/, the features of R&D activities are innovative, new, using scientific methods and producing new knowledge and innovative application. Among the features above, innovation and newness are determinants for R&D, using scientific methods and producing new knowledge and innovative application are the basic features. R&D activities can be divided as several types: basic research, application research and trial research, among them basic research and application research are combined as scientific research.

The intensity of R&D input, i.e., the ratio of R&D on GDP, is considered as a very important indicator to evaluate the S&T capability, and a mark representing national or regional S&T development (Sun Kai, 2006; Zhang Wei, Cheng Jun, 2006[3]).

Because innovation performance is confined to many factors such as input efficiency, knowledge levels, external networks etc., it is rare to say that high S&T input will definitely lead to high economic development(Xiao Yang and Jeff Borland, 2001;Wang Licheng, 2006; Wang Licheng, 2011[4]). Researchers are searching for different methods to demonstrate the relations between input and output, so as to find out the mechanisms (Niu Hong-lei,2010[5];Zhang Wei, Cheng Jun, 2006; Chen C．H., 2003). With the increased investment in basic research, its potency，efficiency and accountability are becoming the focus of attention in various aspects (Ge Guoyao, Song Ziliang, 2003). Whether the R&D input can really promote the regional science innovation level or enhance local economics has a great deal with its effectiveness [6]. Information and Communication Technology (ICT) investments are the driving force behind the resurgence of growth in the developed countries during recent years. They are also the main reason for the increased growth rates of Total Factor Productivity (TFP). Colecchia and Schreyer (2002) showed that during the late 1990s, ICT contributed between about 0.3% and 0.9% per year to economic growth compared with the early 1990s, when ICT contributed only 0.2–0.5%[7].

There are many methods taken to evaluate the S&T input effects: Xu and Shi(2005) assessed the S&T input efficiency based on DEA[8]. Zhang, Tian and Chen(2009) found that R&D input and economic development are interactive, so the mechanism of interaction is Granger reason[9].

2. Index selection

City's S&T progress is the determinative factor of local economic growth and competition[10], evaluating the regional S&T progress status is of great significance. Related researches (Sun, 2010; Zhang Wei, Cheng Jun, 2006; Chen Yunping, Chen Linxin, 2009) have recommended various indicators concerning with S&T input. The indicator systems vary a lot within recent research, especially with the approaching of knowledge-based economy [11]. For the reason of comparative study, this paper mainly refers to the recommended indicators from website of http://www.sts.org.cn/ (China Science and Technology Statistics). This website gives some very often-used and accepted indicators to evaluate and describe the S&T statues. Referenced from ://www.sts.org.cn/, this paper takes R&D expenditure and R&D personnel as the input indicators, representing the factors (human power and capital input) which mainly push economic development.

R&D expenditure is the cost used in basic research, application research and trial development in a given year, including manpower cost, material cost and fixed assets costs, overheads and other costs. In 2008, the R&D expenditure in Chinese mainland is 461.6 billion, 90.5 billion more than, or 24.4% higher than that of last year. Accordingly, the ratio of R&D on GDP is 1.54%. This figure is at a low level when comparing with developed countries. According to IMF, in 2001, the figure in Japan is 3.12%, 2.68% for US [12]. However, China has increased input in R&D in recent years: During the "Eleventh Five" (2006-2010) period, China had increased S&T input year on year. Taking 2009 as an example, the national financial input on S&T was 322.49 billion Yuan, double than that of 2005. The ratio of S&T expenditure